Province of British Columbia

THE REPORT OF THE

PROVINCIAL ADVISORY COMMITTEE ON COMPUTERS

TO THE

MINISTER OF EDUCATION

JULY, 1987

ministry of education

British Columbia. Provincial Advisory Committee on Computers.

The Report of the Provincial Advisory Committee on Computers to the Minister of Education

Cover title.
Bibliography: p.
ISBN 0-7726-0677-3

1. Computer-assisted instruction - British Columbia.
2. Computers - Study and teaching - British Columbia.
I. British Columbia. Ministry of Education. II. Title

LB1028.46.B74 1987 371.3'9445'09711 C87-092129-0

PREFACE

In August of 1985, the Provincial School Review Committee published the ***Let's Talk About Schools*** discussion papers. The Summary and Highlights section of that report stated, "that respondents to questions on technology ... unanimously held that pupils should be given greater access to computers."

The response of the Minister of Education to this strong statement from the public was to establish a Provincial Advisory Committee on Computers for the following purposes:

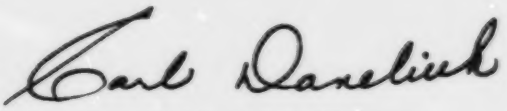
> "To describe how computer technology can be integrated into British Columbia schools in the next decade."
>
> and
>
> "To propose a set of policies that will guide the application of instructional computer technology in British Columbia for the next decade."

The Committee began meeting in September, 1986 to determine its plan of action. Beginning in November, 1986 and continuing through January, 1987, members of the Committee, usually in pairs, travelled through British Columbia to almost every School District. They visited classrooms at all levels, discussed computer-related topics with pupils, teachers and administrators, and held open meetings with school trustees, teachers, and the general public. At these meetings briefs were presented and comments and opinions recorded. Educators from faculties of education were consulted, as were a number of persons from other provinces, and the U.S. Several days were scheduled for presentations from hardware vendors and software developers. Every effort was made to ensure that anyone who wanted to express an opinion to the Committee would have the opportunity to do so.

The Committee then met to develop Policy Options and Recommendations based on the information from these sources. An ***Interim Report,*** with a questionnaire attached, was distributed in early April to determine whether the recommendations fairly represented the information and opinions that were presented to the Committee. In doing so, the Committee sought validation of its findings before submitting this report. A tabulation of responses to the questionnaire indicated very strong support for the recommendations. A number of persons submitted written comments on the ***Interim Report*** and they are identified in Appendix D.

Because the Committee is recommending the expenditure of $125 million over a five-year period, it seems prudent to attempt to assess the impact of such a commitment on the economy of British Columbia. As may be seen in Appendix A, the Ministry of Economic Development has estimated an increase of $137 million in total industrial production over the five years. This would seem to provide substantial justification for the recommendation.

The members of the Committee wish to express their gratitude for the interest and support of all who were involved in the information-gathering process, including those who kindly responded to the ***Interim Report.*** We trust that our joint efforts will achieve the stated purposes to the benefit of all pupils in the schools of British Columbia.



Carl Daneliuk, Chairman

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OBJECTIVES

"To describe how computer technology can be integrated into British Columbia schools in the next decade."

"To propose a set of policies that will guide the application of instructional computer technology in British Columbia for the next decade."

	TERMS OF REFERENCE	OUTCOMES
A)	Determine the Ministry's involvement in the area of instructional use of computers.	Propose a policy statement.
B)	Determine how the computer can enhance a student's education in a more effective manner.	Identify and establish a list of potential uses of the computer. The list should indicate a priority of applications based on a classification system (direct instruction, support applications, and management applications).
C)	Examine the software standards that have been established nationally and internationally.	Propose a policy, and software standards that will support the purchase and development of good instructional software.
D)	Study the potential of site licensing commercial software and the possibility of marketing B.C. developed software.	Recommend licensing options.
E)	Study the capabilities of various hardware configurations.	Recommend computer hardware standards that will support good instructional software.
F)	Examine the process of integrating the computer into the curriculum.	Recommend a curriculum integrations procedure for the Ministry.
G)	Examine the need for teacher inservice and training.	Recommend a provincial teacher inservice plan and guidelines for preservice in educational computer technology.
H)	Explore the communication requirements necessary to ensure effective utilization of computer technology.	Recommend a mechanism to establish effective communication channels.
I)	Determine an implementation strategy and a plan for the integration of computers into the instructional program.	Recommend a timetable, priorities, and a phase-in plan.

MEMBERS OF THE COMMITTEE

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Chapter 1

INTRODUCTION

Schools of the future might have electronic desks that have built-in computers. The teacher could type assignments into the computer which would show up on a student computer. Also, your electronic desk saves writing, all you do is press buttons. You would save paper, pencils, pens, calculators, and rulers, and you could be hooked up to the library computer. And you could do grammar, math, reading, science, social studies.

David Stauffer, Grade 7
John A. Hutton Elementary School
Grand Forks, B.C.

The invention of the computer can be viewed, simply, as the most recent stage in the history of information technology. More than 2000 years ago, the creation of the alphabet by the ancient Greeks provided a method by which information could move from place to place independently of the person who produced it. Fear was expressed at that time that the use of the alphabet would ultimately reduce the ability of people to remember information. Instead, the alphabet provided strong impetus to commerce and discovery, as well as to the scholarship and creative writing of the Greeks and Romans.

Similarly, when Gutenburg invented the printing press in the 15th century it was broadly suggested that the skill of handwriting would be lost to the printed word. What actually happened was that printing technology produced books at such dramatically-reduced cost that it aided the industrial revolution and hastened the arrival of universal public education.

The computer, in the same tradition, has taken the processing of information another significant step forward. Now, anyone with a computer and attached printer can create and publish materials without the need of a printing press. Of greater importance, however, the computer can function as an extension of the human mind by providing information storage and retrieval of almost infinite capacity. Many important human problems, such as the prediction of life-threatening weather systems, that previously were virtually impossible to solve are now being handled, easily, with the aid of computers. Further, computer automation and robotics are revolutionizing the workplace, and providing dramatic increases in productivity. If this progression continues, as is generally expected, there is reason to believe that by the year 2000, most employed people will use computers in one capacity or another.

Because our society is becoming increasingly dependent upon computer technology, it is not surprising that many parents, teachers, students, and society at large, are demanding that the application of computers become an integral part of the school curriculum. From 1980 to 1982, in response to this growing demand, the British Columbia Ministry of Education carried out a Pilot Project to determine the extent to which computers could contribute to student learning. With the cooperation of several School Districts, 100 microcomputers were placed in a variety of school settings. This pioneer study was among the first organized efforts in North America to introduce computers into the schools. The overall results of the Project, however, were not sufficiently clear on the benefits of using computers in the classroom, and the Ministry chose not to extend the Project beyond its second year.

The stage had been set, however, for since that time virtually all School Districts in the Province have acquired computers for their classrooms and laboratories both through their own funds and with the assistance of parent-teacher groups. Moreover, the cost of microcomputers has since dropped substantially, and the quality of educational software has improved dramatically. There also is growing evidence that computers in the hands of well- trained teachers, do enhance pupils' learning. As a result there now is a considerable amount of computer-related activity occurring in our schools which can be attributed to the excellent leadership provided by teachers and school administrators.

There can be no doubt that computers are having a dramatic effect on our society. Virtually no area of human activity is untouched by the rapidly-expanding technology. It is evident, too, that the field of education has a crucial role to play in providing students with the skills necessary to use computer technology effectively. The major purpose of this Report is to ensure that the youth of today will be adequately prepared to meet the challenges of tomorrow.

Chapter 2

ENHANCING THE STUDENT'S EDUCATION

Basically, most of us learn in three ways - by hearing, seeing and touching. One tool which assists learning through all three is the computer. However, the computer is more than a learning device. It is different from any other tool, for it has the great possibility of expanding our creative, intellectual and physical capabilities.

Learning Today:
Computers in Education, A Four Year Plan
Ottawa Board of Education

TERM OF REFERENCE:

"Determine how the computer can support and enhance a student's education in a more effective manner."

OUTCOME:

"Identify and establish a list of potential uses of the computer. The list should indicate a priority of applications based on a classification system (direct instruction, support applications and management applications)."

BACKGROUND:

Computers have been used for instructional purposes for over 25 years. During that time, the range of instructional applications has grown steadily with increases in the capacity of computers. Entire courses at universities and colleges are taught by computer-aided learning (CAL) systems. Many businesses, including the major computer manufacturers themselves, depend on CAL to train their employees in new procedures. Airlines train their pilots and other aircrew on computer-controlled flight simulators in complete safety and with substantial cost savings. Research into the effectiveness of CAL (Kulik, 1983: Kulik, Bangert, & Williams, 1983) has demonstrated that computers can provide exceilent learning experiences, and frequently in considerably less time than by traditional methods. Most of the earlier CAL systems, however, required large computers which meant that costs were rather high, and well beyond the means of most school districts.

The arrival of the microcomputer in the late 1970's changed several factors rather dramatically: it was much less expensive than previous computers; it provided colour

graphics at a fraction of the cost; and it could be operated by almost anyone with a reasonable amount of training. Software for microcomputers became sophisticated to the point where small businesses began purchasing them for management and accounting applications. Then, as educational software became available, microcomputer systems began entering the home and the school, and "computer literacy" became a frequent topic among educators.

Initially, computer literacy was defined rather narrowly in terms of one's ability to program a microcomputer. With recent improvements in the quality of educational software, it is evident that the ability to program a computer is not necessary for its effective use. Hence, the focus today is on one's ability to use the computer in meaningful and productive ways.

Computer applications in education can be placed into one of three major categories: **teaching through computers,** where the computer performs the role of a tutor as in computer aided learning; **teaching with computers,** where the computer is used as a tool, as in word processing and database management; and **teaching about computers,** where the computer itself is the object of study, as in computer science courses, where programming in one or more of several computer languages, such as Logo, BASIC, and Pascal, is taught. Each of these categories offers opportunities for the enhancement of student learning and the Committee found excellent examples in the classrooms that were visited. However, according to most teachers, what is needed at this time are guidelines within which they can extend their use of computer applications.

GOALS FOR THE USE OF COMPUTERS IN THE SCHOOL CURRICULUM:

In considering the roles that computers might play in the learning-teaching process the Committee was guided by the following:

1. **The primary goal for the application of computers in the schools is the enhancement of student learning.**

2. **The secondary goal is support for teachers in their instructional programs.**

3. **The ultimate goal is to ensure that all students, at graduation, will have the skills necessary to function effectively and confidently in an increasingly complex technological environment.**

Each of the recommendations of this Report, therefore, is directed toward ensuring that all students in the schools of British Columbia will benefit from the application of computers.

POLICY OPTIONS:

Option A:

Districts should continue to set their own priorities and principles for the application of computers in their schools.

Option B:

The Ministry should establish the priorities and principles for the application of computers in the schools.

Option C:

The Ministry should establish the broad priorities and principles under which the application of computers in the schools should be carried out, and encourage the Districts to use them to guide their planning and implementation.

Recommended Option:

The Committee recommends that **Option C** guide the Ministry in its development of policy directed at the application of computers in the schools.

RECOMMENDATIONS ON THE APPLICATION OF COMPUTERS IN THE SCHOOLS:

Recommendation 1

"That by 1992, all pupils in the schools of British Columbia will have appropriate opportunities for learning through, with, and about computers."

Comment: The year 1992 is viewed as the earliest in which the recommendations of this report can be realistically achieved. While it would be nice to suggest that the task could be accomplished sooner, the ability of the education system to respond to technological change imposes limits on the rate with which it can be introduced.

Recommendation 2

"That the Ministry adopt the following priorities in providing appropriate opportunities for learning through, with, and about computers. **These priorities should be reviewed annually."**

The recommended priorities should be:

1. Word processing for the development of writing skills, and other productivity tools such as databases and spreadsheets. (Support Applications)

   Comment: There is substantial evidence indicating that these applications are well-developed and widely-used to the benefit of a broad range of pupils. Included with them must be opportunities to develop keyboarding skills at the earliest age possible to enable pupils to use computers comfortably and efficiently.

2. Special education applications. (Direct Instruction and Support Applications)

   Comment: The importance of computers in supporting and enhancing the learning of mentally and physically handicapped pupils is clearly established. The members of the Committee saw numerous examples, including visual speech for the hearing-impaired, and Braille output from word processors for the visually-impaired, where specially-designed software and hardware are being used to the benefit of handicapped pupils. Further, computer aided learning for slow learners and the learning-impaired has long demonstrated its effectiveness. The expansion of these applications must be encouraged.

3. School library access to information/knowledge resources such as public database networks and CD-ROM systems. (Support Applications)

   Comment: Because we are entering the "information age", it is imperative that pupils and teachers have access to the most recent methods of information manipulation and delivery. The school library is the obvious location for these facilities.

4. Business education, industrial education and career preparation. (Support Applications)

   Comment: The remarkable growth of computer applications in business and industry compels the education system to respond.

School-based opportunities for initial learning in these areas are essential.

5. Creative applications for art and music education. (Direct Instruction and Support Applications)

   Comment: Computer-generated graphics and digital music systems are developing at an accelerating rate. Students will benefit from early learning experiences in both areas.

6. Integration of computer aided learning (CAL) into the school curriculum. (Direct Instruction)

   Comment: Many teachers are currently using CAL as an adjunct to their instructional programs. The quality of CAL, often the object of justifiable criticism, is steadily improving. The recent inclusion of videodiscs and CD-ROM with CAL software is capable of providing students with very sophisticated learning environments.

General Comment: This list of priorities reflects the relative importance the Committee observed in the field. However, it is reasonable to assume that there will be variations based upon local circumstances and, therefore, flexibility in its application is to be expected.

The Ministry of Education has previously recognized the importance of formal learning "about" computers by establishing Computer Studies 11 and Computer Science 12 in the British Columbia school curriculum. Except for recommendations on the provision of computer laboratories, therefore, support for these courses is essentially independent of the implications of this Report. However, the Committee strongly supports the continuance of Computer Studies 11 and Computer Science 12.

Recommendation 3

"That separate computing facilities be provided for teacher oriented applications such as classroom management and the preparation of instructional materials."

Comment: The use of computers for the purposes of classroom administration can substantially reduce the time a teacher spends on management tasks. To enable teachers to take advantage of the many useful procedures available, they must have regular access to appropriate hardware and software.

Chapter 3

INTEGRATION INTO THE CURRICULUM

Hardly any school subject will not be affected in some way.

Computers in Education:
Design and Planning

TERM OF REFERENCE:

"Examine the process of integrating the computer into the curriculum."

OUTCOME:

"Recommend a curriculum integration procedure for the Ministry."

BACKGROUND:

When the computer itself is the object of study, as it has been in computer science courses for the past 15 to 20 years, the computer curriculum stands essentially on its own. However, now that the computer is being used as both a tutor and a tool in various subject areas, the need for integration with the curriculum is essential if the potential benefits are to be realized.

In visiting Districts throughout the Province, members of the Committee were in many classrooms where computers were being used effectively. These teachers, through their own initiative and often with the assistance of a District coordinator, seem to have successfully provided the necessary integration. For the most part, however, teachers and administrators have asked for more direction from the Ministry on appropriate ways of merging computers into the instructional process.

What is required, now, is a careful examination of all curricula to determine those components which have the potential for enhancement by computer applications. Those that are identified should be revised to include specifications for appropriate computer-based experiences. The effective use of computers depends upon their importance to the attainment of specific curriculum objectives.

The rate at which hardware and software improvements are taking place suggests that the traditional curriculum revision cycle is too slow. It seems necessary, therefore, to undertake an overall review and to make initial adjustments as soon as possible. Then, each curriculum area should be reviewed every three to five years to ensure that technology is being applied effectively.

POLICY OPTIONS:

Option A:

Districts should continue to provide for the integration of computers into the school curriculum.

Option B:

The Ministry should specify classroom applications and the software required to support them.

Option C:

The Ministry should establish the principles and priorities through which computers can be integrated into the school curriculum, and encourage the Districts to use them to guide their planning and implementation.

Recommended Option:

The Committee recommends that **Option C** guide the Ministry in its development of policy directed toward the integration of computer applications into the school curriculum.

RECOMMENDATIONS ON INTEGRATING COMPUTERS INTO THE CURRICULUM:

Recommendation 4

"That the Ministry review the entire school curriculum, as soon as possible, to determine those areas which would benefit from the inclusion of computer applications, and then develop strategies for their integration."

Comment: The task of integrating computer applications into the school curriculum is critical to achieving the anticipated benefits. The review and development process should be accelerated. The priorities listed in Recommendation 2 should guide the curriculum integration process.

Recommendation 5

"That the Ministry expand its current curriculum revision process to include considerations of computer applications."

Comment: The ongoing revision of individual curricula has not, to date, considered the role of the computer. The list of priorities in Recommendation 2, should guide the review process. The application of computers in the classroom should be essentially determined by the needs of the curriculum.

Recommendation 6

"That all curriculum revision committees contain at least one member with expertise in computer applications."

Comment: This will ensure that each revision committee is supported in its efforts to integrate computers into the curriculum.

Recommendation 7

"That the curriculum revision process be accelerated to accommodate the rapid changes in educational technology."

Comment: The traditional nine-year cycle for the review of curricula is incapable of dealing with the rate at which computer technology is evolving. A maximum cycle of three to five years would seem to be required.

Chapter 4

TEACHER INSERVICE AND TRAINING

Teachers must learn to become managers of a complex educational environment, designers of an individualized learning program for each student, evaluators (and perhaps constructors) of some of the sophisticated tools offered. These tasks will require significant reform in our preservice and inservice programs.

Transforming American Education:
Reducing the Risk to the Nation

TERM OF REFERENCE:

"Examine the need for teacher inservice and training."

OUTCOME:

"Recommend a provincial teacher inservice plan and guidelines for preservice in educational computer technology."

BACKGROUND:

When the microcomputer arrived, many teachers became converts to the computer revolution - they purchased computers for themselves and carried them to school to share their enthusiasm with their students and their colleagues. These pioneers have led the field of education, often with little initial support, into the revolution. They virtually trained themselves to use computers, and then set out as evangelists to show what their wonderful machines could do. They enlisted the assistance of administrators and parent-teacher groups to provide them with more and better equipment, and gave of their own time and effort to demonstrate their belief in the importance of using computers in the schools.

There are teachers, however, who have not developed the same enthusiasm for computers. They tend to be skeptical of what is happening, and view it as a fad that will almost certainly pass, as have so many other educational innovations, and they are going to require solid evidence to the contrary before they will become active participants. Moreover, many teachers feel they already have more to do than they can manage, and the added burden of acquiring the skills necessary to use computers effectively is something they do not need at this time. As a result, a large proportion of the teaching force lacks the

ability to use computers confidently and effectively. However, the Committee found that, under appropriate circumstances, most teachers would be willing to learn how to use computers. This means that a substantial inservice effort will be required if the investment in computer hardware and software is to be justified.

It was suggested to the Committee that a systematic approach to the provision of inservice training is needed. Inservice models should be developed, and resource materials produced. Each District should have a person designated to organize inservice programs. Each school should designate one or more computer resource persons to support the program at the school level, at least during the early implementation period.

It was also suggested that a minimum of three to five days per year of teacher inservice in computer applications is required. Initially, it may be necessary to organize workshops during the summer and on weekends to ensure that sufficient time is available for adequate training. There may be financial recognition for the participants when they are contributing their own time in this way. Some Districts have already used this approach with considerable success. Adequate funding is obviously critical to the success of the inservice program.

It is essential that teachers have regular access to computing equipment as they develop their skills. Computers should be made available for teacher use in the staff room, or in a special computer resource room. It should be possible for teachers to have evening and weekend access to equipment. It may also be possible to arrange discounts for teachers who wish to purchase their own equipment.

The assistance of all agencies capable of providing inservice training is essential. In addition to local resource persons, the Faculties of Education, the Colleges, and Institutes should be encouraged to increase their involvement to help meet the demand.

The role of the new College of Teachers in the provision of teacher inservice is not clear at the present time, however, it is expected to have responsibility in this area.

With regard to the preservice education of teachers, it is recognized that the three Faculties of Education have offered credit courses in computer applications for several years. These courses have been optional components of undergraduate programs. It is evident that future graduates must have the skills that will enable them to use computers effectively in their classrooms. This strongly suggests the need for required courses in computer applications at the undergraduate level.

POLICY OPTIONS ON TEACHER INSERVICE:

Option A:

Districts should carry the responsibility for providing inservice training on computer applications to teachers.

Option B:

The Ministry should assume the total responsibility for teacher inservice including planning, organization, and delivery.

Option C:

Teacher inservice should be viewed as a responsibility to be shared by the teacher, the District, and the Ministry.

Recommended Option:

The Committee recommends that **Option C** guide the Ministry in its development of policy directed at the provision of inservice training to teachers.

RECOMMENDATIONS ON TEACHER INSERVICE:

Recommendation 8

"That the Ministry develop and publish models for the delivery of teacher inservice on the use of computers in the classroom."

Comment: The Committee observed several successful inservice models during its visits to Districts. These models should be collected and distributed.

Recommendation 9

"That the Ministry provide inservice training for teachers when specific computer applications are required by revisions to the provincial school curriculum."

Comment: It is probable that future revisions to provincial curricula will include specifications for computer applications. It will be important to ensure that all teachers affected by the changes are provided with the opportunity to acquire the necessary skills.

Recommendation 10

"That the Districts provide inservice training for teachers when specific computer applications are required by the District."

Comment: Districts should provide their teachers with the additional skills they require to accommodate locally-determined priorities.

Recommendation 11

"That the Faculties of Education, Colleges, Institutes, and other training organizations be encouraged to increase their efforts in providing inservice training to teachers."

Comment: The amount of inservice training needed will require the cooperation of all who are able to provide it.

Recommendation 12

"That Districts be encouraged to establish policies through which teachers will have access to computers, either at school or at home, for the purposes of improving teacher skills in using computers."

Comment: The amount of time required for teachers to become proficient in their use of computers is substantial. Accessibility to computers is critical to the development of teacher skills.

Recommendation 13

"That the Ministry encourage Districts to organize special inservice programs on computer applications for school administrators."

Comment: The evidence is very clear that the knowledge, interests, and attitudes of school administrators are crucial to the implementation of innovation.

POLICY OPTIONS ON TEACHER PRESERVICE:

Option A:

The Ministry should require that one or more formal courses in educational computer applications be taken by undergraduate students prior to their certification as teachers.

Option B:

The Ministry should expect that all student teachers will have the opportunity to learn through, with, and about computers, and be able to use computers in the school classroom.

Recommended Option:

The Committee recommends that **Option B** guide the Ministry in its development of policy directed toward the Faculties of Education for the provision of preservice training to teachers.

RECOMMENDATIONS ON TEACHER PRESERVICE:

Recommendation 14

"That the Ministry expect the Faculties of Education to provide student teachers with opportunities that will teach them how to use computers and how computers can be used effectively in the school curriculum."

Comment: It is critical that beginning teachers be able to use computers from the first day in their own classrooms.

Recommendation 15

"That the Ministry encourage the Faculties of Education to carry out research into new and effective ways of integrating computer technology into the curriculum "

Comment: The universities have an important role to play in guiding the development and use of this educational innovation.

Chapter 5

SOFTWARE STANDARDS

...the first rule of survival is clear: nothing is more dangerous than yesterday's success.

Alvin Toffler
The Adaptive Corporation

TERM OF REFERENCE:

"Examine the software standards that have been set nationally and internationally."

OUTCOME:

"Propose a policy, and software standards that will support the purchase and development of good instructional software."

BACKGROUND:

High quality educational software is critical to the effective use of computers in the schools. The Committee was informed, repeatedly, of the need for more and better software that is more closely linked to the British Columbia school curriculum.

The Provincial Educational Media Centre (PEMC) currently provides the schools of British Columbia with an important service by evaluating a broad range of educational software, and regularly publishes the results of those evaluations. The evaluations have been carried out by a network of teachers in the field, within the framework of a set of criteria developed by PEMC. While these criteria have been successful in distinguishing between good and poor software, they were not designed to determine the extent to which the software applied, specifically, to the British Columbia school curriculum. What is needed now, as the growth of computer applications in the classroom continues, is the extension of these criteria into a set of standards which would encompass all aspects of instructional use. The ultimate goal of improved educational software standards should be a steady improvement in the quality of this important instructional resource.

Even greater improvement in the quality of educational software could be expected if two or more provinces combined their efforts in the design and development of exemplary software. The benefits of such cooperation, over the long term, would be reflected in a

greater opportunity to influence the quality of software that is produced, the creation of a better software base, and the possibility of substantial cost savings.

POLICY OPTIONS:

Option A:

The Ministry should continue the present system of providing software reviews to guide the purchase of software by the local district or school. In other words, maintain the status quo.

Option B:

The Ministry should establish more rigorous evaluation criteria and apply them to selected software appropriate to the curriculum. Teachers would be provided with a list of "Ministry- approved and recommended" educational software. "Supplementary" software would continue to be evaluated under the current system of field trials by one or more teachers. The information generated by these enhanced evaluation procedures would be made available, as quickly as possible, to teachers and administrators. Cooperation with other educational jurisdictions on the development of exemplary software, based on better software standards, should be actively pursued.

Recommended Option:

The Committee recommends that **Option B** guide the Ministry in its development of policy directed at improving educational software standards for British Columbia.

RECOMMENDATIONS ON SOFTWARE STANDARDS:

Recommendation 16

"That the Ministry expand its current software evaluation service to ensure that the schools of British Columbia are provided with a high standard of educational software."

Comment: The service presently being provided by PEMC contains the basis for the recommended expansion. However, a substantial extension of this service would be required to achieve the suggested outcome.

Recommendation 17

"That the present PEMC evaluation criteria form the basis for the creation of specific software standards that would provide for evaluations of: educational content, congruence with the British Columbia school curriculum, instructional methodology, social context, and achievement criteria."

Comment: Current use of computers in the classrooms of British Columbia, with the exception of Computer Studies 11 and Computer Science 12, is extra to the requirements of the curriculum. It is now essential that the classroom use of computers should be "added-in" to the curriculum, as opposed to being "added-on" to it. The proposed standards are necessary to ensure that appropriate software is selected.

Recommendation 18

"That the results of software evaluations be made readily available to teachers and administrators throughout the province."

Comment: Because improved software is constantly entering the market, it is important that the latest information be disseminated as quickly as possible.

Recommendation 19

"That the Ministry extend its cooperation with other educational jurisdictions on the creation of improved criteria and standards for software evaluation."

Comment: The software development industry has indicated its eagerness to respond to the stated needs of education. The combined efforts of two or more jurisdictions will have greater impact in shaping future software development than those of a single province.

Recommendation 20

"That the Ministry seek opportunities to enter into joint ventures with other educational jurisdictions for the purposes of designing and developing exemplary software."

Comment: While the province of British Columbia comprises a substantial market for educational software, there would be considerable benefit in entering into joint ventures with other jurisdictions. Such cooperation would permit both the design and the development of commonly-used software, within the guidelines of a comprehensive set of standards. It seems reasonable to suggest that there would also be associated cost advantages.

Chapter 6

SITE LICENSING OF SOFTWARE

The appropriate response to more technology is not to stop it, Luddite-like, but to accommodate it, respond to it, and shape it.

John Naisbett
Megatrends

TERM OF REFERENCE:

"Study the potential of site-licensing commercial software, and the possibility of marketing B.C.-developed software."

OUTCOME:

"Recommend licensing options."

BACKGROUND:

Most software, currently, is purchased by schools from local suppliers, or directly from developers and publishers. These individual purchases, however, do not benefit from the cost savings that would result from the combined purchasing power of several Districts, or from arrangements made by the Ministry on behalf of all Districts. There are at least three ways in which the Ministry could assist in reducing the cost of software.

The first of these is to negotiate "site licenses" with suppliers of frequently-used software. For a flat fee, the Ministry buys the rights to specific software which can then be used on an unlimited basis throughout the Province. As an example, software produced by the Minnesota Educational Computing Consortium (MECC) is available from the Provincial Educational Media Centre (PEMC) under the terms of a site license that was first negotiated in 1980. This arrangement has provided the schools of the Province with useful software at a reasonable cost.

"Bulk purchasing" agreements provide an alternative method of reducing the costs of software. The Ministry can enter into a contract with a software supplier to purchase a specified quantity of a given product. Because of the high volume, the negotiated price would be well below that which a school, or even a District, could expect to pay.

A useful variant of bulk purchase agreements is the "supply contract", in which a supplier agrees to provide a product for a stated price to any person or agency that is covered within the contract. Thus, teachers, schools, or Districts can purchase directly from the supplier at the agreed price. The PEMC has used supply contracts, very successfully, in arranging for local purchase of low-cost blank diskettes for the schools of British Columbia.

Because most of the software used in the schools comes from suppliers with whom no site license or bulk purchase agreement has been negotiated, supplying a computer laboratory of 15 stations with a software package priced at $200 will cost the school $3,000. Since few schools can afford to buy many packages at these prices, teachers have been placed in the ambiguous position of either copying software or going without a useful program. Those who choose to go without may be denying their students important learning experiences. Those who choose to copy could be breaking the law. The implications of this are obvious, and site licensing or bulk purchasing appear to offer the most reasonable solutions.

The Committee was informed that most of the educational software available at this time is either inadequate, or too expensive, or both. There was a strong plea for Ministry intervention so that the quality of software might increase and the costs be reduced. This would involve site licensing or bulk purchasing those software packages that are found to be of sufficient quality and utility for general use. It might also require contracted development if quality software is not available at reasonable cost.

POLICY OPTIONS:

Option A:

Districts and schools should continue to purchase educational software according to their own requirements and means.

Option B:

The Ministry should assist schools and Districts by negotiating site licenses or bulk purchases for frequently-used educational software. Where such arrangements cannot be made, or where a specific deficiency in the supply of software is identified, the Ministry should contract with software developers to meet the requirements.

Recommended Option:

The Committee recommends that **Option B** guide the Ministry in establishing policy on site licensing, bulk purchasing, and the acquisition of contracted software.

RECOMMENDATIONS ON SITE LICENSING:

Recommendation 21

"That the Ministry review the educational software requirements of the Province, and where indicated by a potentially high frequency of use, negotiate provincial site licenses or bulk purchasing agreements with the suppliers of the software."

Comment: The Ministry will not hold an exclusive right to negotiate site licenses and bulk purchases. Districts and schools may find it useful to enter into supply agreements of either type.

Recommendation 22

"That where satisfactory site licenses or bulk purchasing agreements for frequently-used educational software cannot be negotiated, or where a useful software package is not commercially available, the Ministry contract with software developers, giving preference to those in British Columbia, to provide the required software."

Comment: The software development industry in British Columbia has a growing reputation for the quality of its products. There is evidence that funds spent on software development provide very substantial benefits to the local economy.

Recommendation 23

"That where the Ministry assumes the total cost of the development of a software package it should retain full copyright, and arrange for marketing of the product beyond British Columbia."

Comment: For software development contracts in which the Ministry assumes only part of the cost of development, ownership of copyright and marketing rights would be negotiable.

Chapter 7

HARDWARE STANDARDS

Computer hardware will continue its rapid improvement in price to performance ratio.

David Moursund
Computers in Schools:
A Strategic Planning Symposium

TERM OF REFERENCE:

"Examine the capabilities of various hardware configurations."

OUTCOME:

"Recommend computer hardware standards that will support good instructional software."

BACKGROUND:

In the Pilot Project of 1980-82, the choice of the Apple II Plus was based primarily on the fact that a considerable amount of software was available for that microcomputer. Many schools throughout the Province followed this lead and purchased similar equipment. A province-wide survey, carried out by the Ministry in the spring of 1986, indicated that approximately 65% of the microcomputers in the schools of British Columbia were Apples, or Apple compatibles. Commodores comprised about 26%, while IBM PCs and PC compatibles were at 5%. The remaining 4% were from various manufacturers including, Acorn, Tandy and Coleco. There were approximately 11,700 microcomputers in schools at that time.

Except for the Pilot Project, there has been no indication from the Ministry of any preferred models of microcomputer. As a result, Districts have purchased computers according to their own judgements. Most of the costs of hardware, software, and support mechanisms have been assumed by the Districts. However, a very large proportion of the hardware was purchased with funds raised by parent and teacher efforts. In travelling through the Province, members of the Committee observed that most of these computer facilities were achieving their intended objectives, but that there was great disparity in the extent to which the schools of various Districts were equipped. There were many requests from teachers and administrators for Ministry policies that would assist in bringing about equity of student access.

The matter of purchasing hardware has been made even more complicated by recent increases in the capacity and performance of microcomputers, together with relative decreases in their cost. This has raised questions as to the "best" model to purchase for present and future applications. Also, the Funds For Excellence program seems to have encouraged more active sales efforts by computer vendors. As a result, many districts have expressed concern about having to make purchasing decisions without the benefit of external guidelines.

It is generally acknowledged that the decision to purchase microcomputers for educational purposes should follow a thorough review of the specific applications to be used in the school, and the identification of the software available to support those applications. The decision of which computer to buy would, therefore, be based upon its ability to support the specified applications. It is evident that no single computer can totally satisfy the current range of applications from kindergarten through grade 12.

There are several technical factors to be considered in the selection of computer hardware. Foremost among these is the specific operating system (OS) within which the computer performs its tasks. This is important because it essentially determines the software that can be used, and therefore imposes limits on the range of classroom applications. There are currently three operating systems which dominate the microcomputer market: Apple II, Apple Macintosh, and IBM PC-DOS (and MS-DOS). A fourth, Unix (or Unix-like OS) as used by the AT&T and Icon systems, is already established as an important minicomputer operating system, and has the potential for becoming such with microcomputers. Virtually all computer manufacturers produce machines that can use at least one of these operating systems.

In general, most microcomputers on the market are capable of providing teachers with reasonably reliable performance, and reliability has steadily improved to the point where it is seldom a factor in the selection process. Of real concern, however, are such matters as the quality and cost of maintenance and support provided by the computer supplier. The period of the initial warranty and the cost of extending it is also important in the selection decision. Training for teachers, administrators, and technicians is provided by some vendors, but not by others.

Further considerations in selecting a computer include the vendor's policies on upgrading equipment that has been made obsolete by the introduction of new and better models, and the compatibility of previously-purchased software with the new computer systems. It is estimated that the useful life of a microcomputer is between three and five years. Since good software often remains useful for a longer period, it is important that it be able to run on the new system, otherwise the real cost of the new system must include the purchase of new software.

A matter that currently is complicating the purchase of microcomputers is the legal position of "compatibles" and, more particularly, "clones." A compatible will accommodate 90% to 95% of the software that was designed to run on a microcomputer produced by one

of the major manufacturers such as Apple or IBM. A clone is capable of running virtually all of the software that runs on its counterpart. The essential difference between compatibles and clones is the existence of special proprietary microchips installed in the clone that enables it to run copyrighted software. Several clones have been declared illegal by judicial decisions, and others are currently involved in court action. When purchasing computers, the Ministry and School Districts should be assured that the equipment falls within legal requirements.

The microcomputer industry has not been able to settle on a single set of standards to serve the full range of its products, and it seems unlikely to do so in the foreseeable future. As a result, teachers and administrators have appealed for guidelines within which computers may be purchased so as to protect the investment as far into the future as possible. It seems timely and appropriate, therefore, that the Ministry establish policies and minimum standards to assist in the selection of computer hardware. Because the capacity of hardware is changing almost continuously, the recommended standards should be reviewed and updated regularly.

POLICY OPTIONS:

Option A:

The Ministry should maintain the status quo, whereby each District carries total responsibility for the selection of computing equipment according to its own specifications.

Option B:

The Ministry should recommend a single microcomputer system, judged capable of supporting the majority of educational applications, for use in the schools of British Columbia.

Option C:

The Ministry should recommend two or three microcomputer systems, based on their relative capabilities, for use in the schools of British Columbia.

Option D:

The Ministry should set appropriate standards, or guidelines, for the purchase of computing equipment that will support the full range of classroom applications. Any software support provided by the Ministry would be limited to three or four operating systems. The Ministry would provide the Districts with a decision-making model to assist in the selection process. The standards would be reviewed annually, by the Ministry, to ensure they are concurrent with developments in the computer industry.

Recommended Option:

The Committee recommends that **Option D** guide the Ministry in its development of policy directed at establishing standards for the purchase of computer hardware for the schools of British Columbia.

RECOMMENDATIONS ON HARDWARE STANDARDS:

Recommendation 24

"That the Ministry adopt the following standards as guidelines for the acquisition of computing hardware, and that the standards be reviewed annually."

The recommended **minimum** hardware standards should be:

1. Microcomputers that have the capability of using, without restriction, one or more of, Apple ProDOS, Apple Macintosh OS, IBM PC-DOS/MS-DOS, and UNIX.

2. Random Access Memory of 256 Kilobytes.

3. 700kb of disk storage.

4. Two available peripheral expansion slots, and/or one small computer systems interface (SCSI) connector.

5. One serial and/or one parallel interface unit.

6. Capability of connecting to a local area network.

7. An initial one-year comprehensive warranty, with extendable maintenance contracts covering a total of five years.

8. Assurance of the compatibility of current software with each introduction of a more advanced model.

9. Assurance that current equipment can be upgraded at reasonable cost with each introduction of a more advanced model.

Comment: These standards are intended to provide a framework within which Districts can purchase appropriate computing hardware for general classroom and laboratory use. For special applications, such as computer aided drafting, keyboard skill development, and education of the handicapped, it may be necessary to depart from them. Colour output will be required for most CAL applications, and this should be considered at the time of purchase.

Recommendation 25

"That School Districts apply the Ministry's standards to all future purchases of computing equipment."

Comment: Most Districts have demonstrated the ability to select and use computers effectively in their schools. The standards suggested here should ensure that appropriate decisions will continue to be made within the context of province-wide guidelines. There may be circumstances where it is desirable to select equipment beyond these guidelines. In such cases, there should be clear justification for doing so

Chapter 8

COMMUNICATIONS

Business no longer does business as usual: information is money, and information technologies increase human productivity.

Watson, Calvert, & Brinkley (1987)

TERM OF REFERENCE:

"Explore the communication requirements necessary to ensure effective utilization of computer technology."

OUTCOME:

"Recommend a mechanism to establish effective communication channels."

BACKGROUND:

The world is rapidly becoming a "global village." It is possible, for example, for a pupil in British Columbia to participate in a computer conference with others throughout the world. The same pupil can also access one of the many public databases, in such places as Toronto, San Francisco or New York, to obtain information on virtually any topic. Many teachers are already providing their pupils with these opportunities by connecting microcomputers to regular telephone lines.

We are entering the "Information Age" in which access to information will be of much greater importance than ever before. The computer revolution is the force that is driving us in this direction. Business, industry and government depend heavily on computer networks to communicate the information necessary to keep them in operation. While the benefits of computer networks in the business environment are well established, it is not clear at this time whether the benefits of computer networks outweigh the costs. Several Districts in the Province have already networked their schools. These Districts should be able to provide information on the usefulness of their local networks.

Members of the Committee received many requests for better access to information on a variety of topics. An obvious solution would be a province-wide educational network which would also allow national and international connections. Such a network could be used for a variety of purposes. For example, software could be distributed directly to teachers over the network. In addition, student records could be transferred, administrative

and curriculum notices could be distributed, and teachers and students could have access to a variety of databases. Electronic mail could be used to facilitate communications among all users of the network, which could include international student communications.

POLICY OPTIONS:

Option A:

The Ministry should continue the current policy of using public network access to School Districts. The Ministry should encourage the expansion of access to a public network service to include all schools in the Province.

Option B:

The Ministry should develop a province-wide computer network that would link all schools, Districts, and the Ministry. Access to a variety of database services would be provided. The Ministry would establish the technical specifications for the network, and would be responsible for links among the Districts and the Ministry. The Districts would be responsible for links among schools and the District offices.

Option C:

The Ministry should undertake a broad-based study of the benefits of using computer communications networks and database access. Districts should be guided in their development of networks linking schools with District offices.

Recommended Option:

The Committee recommends that **Option C** provide the basis for the immediate and short-term development of policy on computer-based communications, and that **Option B** be adopted as the longer-term policy objective if the studies demonstrate benefits in relation to costs.

RECOMMENDATIONS ON COMMUNICATIONS:

Recommendation 26

"That the Ministry provide leadership by establishing the technical specifications for computer communications networks, and by evaluating the benefits of computer communications networks in relation to their costs."

Comment: There is a great variety of networking systems available. Guidelines are necessary to ensure interconnections among the systems being used. However, it is not clear at this time whether the benefits of using networks outweigh their costs, therefore it would be important to have this information available for planning purposes.

Recommendation 27

"That the Ministry negotiate the bulk purchase of database services from public network utilities."

Comment: The costs of accessing public databases can be very high. There would be substantial savings if the Ministry were to arrange for province-wide school access to one or more of these systems.

Recommendation 28

"That the Ministry encourage Districts to evaluate the potential benefits of computer communications networks, and where found to be advantageous, encourage the establishment of District networks."

Comment: Some Districts may gain more than others from the use of an intra-district computer network. Each District should determine whether it can benefit from such a network and act accordingly.

Recommendation 29

"That, if the results of the recommended evaluations demonstrate the utility of computer communications networks, the Ministry should initiate the development of a province-wide Educational Computer Network."

Comment: A network linking the schools, Districts, and the Ministry would accommodate, in addition to electronic mail and database access, the delivery and exchange of software, instructional materials, achievement test items, and student records. When this range of uses is considered, the benefits may well justify the costs.

Chapter 9

THE MINISTRY'S INVOLVEMENT

The conclusion is inescapable. To bet on a low-tech future would be foolish, unfair to our children, and dangerous to the economic health of this country.

Bill Honig
Last Chance for Our Schools

TERM OF REFERENCE:

"Determine the Ministry's involvement in the area of instructional use of computers."

OUTCOME:

"Propose a policy statement."

BACKGROUND:

The lack of direct Ministry involvement in the development of computer applications in the schools has led to great disparity in the quality of computer facilities across the Province. There is an obvious need for more and better hardware and software if the potential of computer applications in the schools is to be realized. There is also the need to train teachers in the use of computers, and to provide them with the support necessary to use computers effectively in their classrooms.

It is important that the Ministry provide the leadership and support necessary to ensure that access to computers in the schools of British Columbia is equally available to all students. The Committee offers the recommendations of this Report to the Minister as the basis for the development of policies and actions that will guide the effective use of computers in the schools of the Province through the foreseeable future.

POLICY OPTIONS:

Option A:

The Ministry should limit its involvement to encouraging Districts and teachers to proceed with the task of using computers effectively in the schools, and to provide some funds to assist in the task.

Option B:

The Ministry should provide leadership and organization for the orderly development of computer applications in the schools. It should undertake a review of the entire school curriculum and within it identify, and recommend for use in the schools, those computer applications that have the potential for improving student learning. The Ministry should arrange for the necessary funding to carry out the recommendations contained in this Report.

Recommended Option:

The Committee recommends that **Option B** guide the Ministry in its development of general policy on the instructional use of computers.

RECOMMENDATIONS ON MINISTRY INVOLVEMENT:

Recommendation 30

"That the Ministry of Education place a high priority on carrying out the recommendations of this Report."

Comment: While the costs involved are substantial, the Committee is unanimous in asserting the need for the Ministry to provide leadership and support for the application of computers in the schools.

Recommendation 31

"That the Ministry undertake a rolling five-year plan for the development and support of computer applications in the schools, and that this plan be reviewed and adjusted annually to accommodate changes in the technology."

Comment: Given the high rate of development in computer hardware and software, any attempt at long-term planning and development must include a periodic review.

Recommendation 32

"That the Ministry continue to apply the principles of equalized funding in providing for the costs associated with the development of computer applications in the schools."

Comment: Large variations in the size of schools would lead to imbalances in the quality of computer support unless smaller schools are provided with greater per capita resources.

Chapter 10

THE IMPLEMENTATION PLAN

Schools should relate computer resources to their educational objectives. Specifically, all students should learn about computers; learn with computers; and, as an ultimate goal, learn from computers.

Ernest L. Boyer
High School

TERM OF REFERENCE:

"Determine an implementation strategy and a plan for the integration of computers into the instructional program."

OUTCOME:

"Recommend a timetable, priorities, and a phase-in plan."

Recommendation 33

The Committee recommends the following for the initial five years (September 1, 1987 - June 30, 1992) of a rolling five-year plan. The outcomes of year one should be reviewed, and appropriate adjustments made to years two through five. Year six would then be included in the projection.

The dollar amounts indicated are the best estimates that can be made at this time. The average annual cost is estimated at $25 million, which is approximately $54 per pupil per year, and a total of $125 million for the five-year period. This expenditure is equivalent to an average of $30 per year from each household in the Province. However, under current funding arrangements, the average cost would actually be about $7.50 per household per year.

While not readily quantifiable in the short term, financial investment in the educational use of computers will have a positive impact on the provincial and local economies. Value added to the hardware purchases, stimulation of the provincial software industry, growth in maintenance and support services, and expansion of the professional inservice force will create jobs and bring a financial return to the local and provincial governments.

At the request of the Committee, the Ministry of Economic Development has applied the current B.C. Input-Output Model to estimate the the impact of the recommended

expenditure on the Province's economy. That report, which may be seen in Appendix A, indicates a net benefit of $12 million over the five-year period - a compelling reason to view the expenditure as a good investment.

In the long term, however, the most significant return on the investment will be in our graduating students, skilled in the use of computers, who will continue to contribute to the Province's development far into the future.

33.1 TEACHER INSERVICE ($3.2 million/year)

An average of five days of inservice training should be provided for one-fifth of the entire teaching force in each of the five years.

The Ministry should encourage Districts to establish policies whereby teachers will have access to microcomputers out of teaching time at school, and at home during evenings and weekends.

The Ministry should encourage hardware vendors to sell microcomputers at the lowest cost possible to teachers who wish to purchase systems for themselves. The possibility of income tax deductions for teachers purchasing educational computers should be explored.

The Ministry should request the assistance of the Faculties of Education, the Colleges, the Open Learning Authority, the College of Teachers and other suppliers of inservice training.

33.2 SOFTWARE ($3.0 million/year)

The Ministry should immediately assist Districts in ensuring the legality of all educational software currently being used in the Province's schools.

The Ministry should establish review procedures to identify appropriate links between the existing school curriculum and currently-available computer applications. The findings of the review should be incorporated into the school curriculum as quickly as possible.

The Ministry should identify the most frequently-used software packages, and then negotiate site licenses, bulk purchases, or software development contracts to ensure that software is available to schools at minimum cost.

The Ministry should increase the flow of information to teachers about the availability of appropriate classroom applications of software.

The Ministry should expand the functions of the Provincial Educational Media Centre to include the acquisition, evaluation, and distribution of educational software.

33.3 HARDWARE ($12 million/year)

There should be the overall objective of purchasing an average of 6,000 microcomputer systems per year for the five-year period, 1987 - 1992. The average cost for a computer workstation is estimated at $2,000. The total acquisition of 30,000 computers would provide a ratio of one computer for every 16 students. The combination of the new purchases and those already in the schools, would result in a ratio of approximately one computer for every 12 students. This compares to proposals for a 1:8 ratio by 1985 in the Province of Alberta (which has not yet been attained), and for a 1:7 ratio by 1990 in the Ottawa Board of Education. Further, in its report to the U.S. Secretary of Education, the National Task Force on Educational Technology stated that, "the projected installed base of 2.8 million computers in 1989 represents an average of one computer for every 15 students, still a fairly high ratio. This ratio needs to be further decreased, particularly in environments that emphasize subject-matter mastery for each student." (U.S. Department of Education, 1986, p.11)

At the completion of the five-year period:

1. Each medium to large **senior secondary school** in the Province should have a **minimum** of three microcomputer laboratories, each with at least 15 workstations. Additional computers for classroom applications should be provided on the basis of demonstrated need. Smaller senior secondary schools should have facilities scaled to their specific requirements.

2. Each medium to large junior secondary school in the Province should have a **minimum** of two microcomputer laboratories, each with at least 15 workstations. Additional computers for classroom applications should be provided on the basis of demonstrated need. Smaller junior secondary schools should have facilities scaled to their specific requirements.

3. Each elementary school in the Province should have a **minimum** of one microcomputer system per classroom. These may be dispersed through the school in appropriately-designed classroom locations, or in a dedicated laboratory. It will be necessary to increase this ratio for small elementary schools to ensure an adequate minimum number of computers.

4. All documented requirements for computing equipment for special education and learning assistance purposes should be satisfied.

5. Each school library in the Province should have a microcomputer system connected to a modem for communications. In addition, each library should have a CD-ROM player for access to databases such as encyclopedias.

6. The upgrading of obsolete and unreliable computing equipment should be an ongoing process.

33.4 COORDINATION AND MAINTENANCE ($3 million/year)

Coordination of District computer activities is essential, and may be provided by a single person (either full or part time) or by a coordinating committee. A formal training program for District computer coordinators should be developed and administered by the Ministry.

Depending on the size of the school, one or more school-based computer resource persons should be identified for each school in the Province. The role of the computer resource person should be defined by the District. A formal training program for school resource persons should be developed by the Ministry and administered by the Districts. The training of school resource persons should be provided by the District in sequence with the installation of new computers into the schools.

Computer technicians for each District should be identified and provided with the training necessary for local maintenance services.

33.5 PHYSICAL PLANT ($2.8 million/year)

The Ministry should immediately undertake a comprehensive survey of the alterations to buildings that will be necessary to provide for the recommendations of this Report.

Specific standards should be established for each area of the school where computers may be operated, including classrooms, laboratories, and special education rooms. These standards should include specifications for: space, lighting, climate control, health and safety, furniture (ergonomics), electrical supply, access, and security. Each District should then develop a formal plan for the required upgrading of its physical plant, and submit the plan to the Ministry for approval and funding. These standards would be applied to all new school construction.

33.6 COMMUNICATIONS ($500,000/year for two years)

Public network access should be expanded to include all Districts.

Each District, where appropriate, should establish a computer communications network linking all of its schools, within Ministry guidelines.

Because the benefits of a Provincial network are difficult to quantify in relation to the costs, the Ministry should undertake studies, and support pilot projects directed toward assessing network operations and database applications. A decision to proceed to a full network would be based on the results of the pilots.

33.7 CURRICULUM DEVELOPMENT AND INTEGRATION ($200,000/year)

The Ministry should direct the Curriculum Development Branch to undertake the steps necessary to support the integration of computer applications into the school curriculum.

33.8 RESEARCH & DEVELOPMENT, AND EVALUATION ($600,000/year)

The Ministry should establish an educational technology centre with responsibility for acquiring and disseminating information, software evaluation, contracting for research and development activities in support of computer applications, and evaluating the progress of all programs and activities recommended in this Report. This office should be commissioned to function as a central information centre. It should regularly provide teachers with a broad range of information on educational computer applications.

Comment: Corporate involvement in the design, operation, and support of the centre should be encouraged. Other educational jurisdictions in Canada and the U.S. have established similar centres in cooperation with computer companies and software developers to provide mutual benefits.

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APPENDIX A

ECONOMIC IMPACTS OF THE REPORT

Province of British Columbia

Ministry of Economic Development

MEMORANDUM

To: Carl Daneliuk
Assistant Deputy Minister
Management Operations
Ministry of Education
BUILDINGS

Dated: Jan. 16, 87

RECEIVED
JUN 22 1987
ASSISTANT DEPUTY MINISTER
MANAGEMENT OPERATIONS

re: Economic Impacts, Proposed Education Computer Technology Program

As requested, the B.C. Input-Output Model was used to estimate the economic impacts of the proposed Education Computer Technology Program as outlined in the Interim Report by Provincial Advisory Committee on Computers.

Based on expenditure data from the report and Har Singh's discussion with you regarding the B.C. content, impact on the British Columbia provincial economy in terms of gross output, provincial GDP, and employment are summarized in the following table.

Economic Impacts of the Proposed Program
(Thousands of $1987)

	Output	Employment (Person-Years)	GDP
Direct	73,560	1,508	52,177
Indirect & Induced	63,378	933	35,477
Total	136,938	2,441	87,654

The direct output impacts associated with a proposed 5 year expenditure total of $125 million would be about $74 million because most of the hardware is assumed to be imported from outside the province. The project is estimated to increase total industrial production by $137 million and generate 2440 person-years of employment over the five year period.

for

William P. McReynolds
Provincial Statistician
Central Statistics Bureau

Attachment

cc: H. Singh

18/JUN/87(THU) 9:02 VERSION M1.2

BC INPUT OUTPUT CLOSED MODEL - INDUSTRY VERSION

ECONOMIC IMPACTS OF PROPOSED EDUCATIONAL COMPUTER TECHNOLOGY PROGRAM

1987 PRICES

OUTPUT IMPACTS ($ THOUSANDS)

		DIRECT	INDIRECT	INDUCED	TOTAL
1	AGRICULTURE	0	0	0	0
2	FORESTRY	0	40	945	985
3	FISHING,HUNTING AND TRAPPING	0	877	250	1,127
4	MINING	0	9	93	102
5	FOOD AND BEVERAGES	0	324	468	793
6	OTHER MANUFACTURING	7,000	111	3,178	3,289
7	CONSTRUCTION	7,000	6,139	4,019	17,158
8	TRANSPORTATION, STORAGE AND COMM.	1,000	389	1,114	8,503
9	ELEC. POWER,GAS,OTHER UTITITIES	0	2,553	3,433	6,986
10	WHOLESALE AND RETAIL TRADE	8,560	417	1,169	1,586
11	PERSONAL SERVICES	19,000	1,759	5,869	16,188
12	OTHER SERVICES	31,000	542	5,625	25,167
			11,221	12,835	55,055
TOTAL.....		73,560	24,381	38,997	136,938

GDP IMPACTS ($ THOUSANDS)

		DIRECT	INDIRECT	INDUCED	TOTAL
1	AGRICULTURE	0	0	0	0
2	FORESTRY	0	25	584	609
3	FISHING,HUNTING AND TRAPPING	0	354	101	455
4	MINING	0	7	68	74
5	FOOD AND BEVERAGES	0	215	308	523
6	OTHER MANUFACTURING	3,034	36	1,088	1,124
7	CONSTRUCTION	3,095	2,366	1,364	6,765
8	TRANSPORTATION, STORAGE AND COMM.	893	182	496	3,773
9	ELEC. POWER,GAS,OTHER UTITITIES	0	1,800	2,388	5,082
10	WHOLESALE AND RETAIL TRADE	6,090	356	1,003	1,359
11	PERSONAL SERVICES	14,514	1,285	4,599	11,974
12	OTHER SERVICES	24,550	308	3,437	18,259
			4,746	8,361	37,657
TOTAL.....		52,177	11,680	23,797	87,654

EMPLOYMENT IMPACTS (PERSON YEARS)

		DIRECT	INDIRECT	INDUCED	TOTAL
1	AGRICULTURE	0.000	1.034	24.316	25.351
2	FORESTRY	0.000	6.671	1.899	8.570
3	FISHING,HUNTING AND TRAPPING	0.000	0.160	1.665	1.824
4	MINING	0.000	1.011	1.152	2.164
5	FOOD AND BEVERAGES	0.000	0.709	21.213	21.922
6	OTHER MANUFACTURING	117.216	57.559	35.837	210.612
7	CONSTRUCTION	74.266	3.687	11.663	89.616
8	TRANSPORTATION, STORAGE AND COMM.	15.363	46.399	61.103	122.864
9	ELEC. POWER,GAS,OTHER UTITITIES	0.000	4.650	12.803	17.453
10	WHOLESALE AND RETAIL TRADE	159.484	36.884	160.333	356.701
11	PERSONAL SERVICES	186.275	16.193	168.028	370.496
12	OTHER SERVICES	955.474	163.824	93.929	1,213.227
TOTAL.....		1,508.077	338.783	593.939	2,440.799

ATTACHMENT 1 - DEFINITIONS AND STANDARD ASSUMPTIONS

Direct impacts are those generated directly within the sector whose domestic output increased by an amount equal to the initial increase of demand for its product less imports.

Spin-off impacts consist of both indirect and induced effects as defined below.

Indirect impacts are those generated in other sectors which supply raw materials and other inputs required for the production of the increase level of sectoral output. The level of these indirect impacts depends mainly on the degree of sectoral inter-dependence and the amount of domestic contents of the required raw material and supplies. The higher the degree of sectoral interdependence and the domestic contents of inputs, the higher the amount of indirect impacts generated by a certain sector on the rest of the domestic economy.

Induced impacts are those generated by higher consumer expenditure as a result of higher household income. The level of these impacts depends mainly on the ratio of labour income to total sectoral income.

Following are the major assumptions made for the purpose of these simulations:

- Output impacts are based on 1979 technology for producing goods and services as presented in the British Columbia Input-Output tables. Furthermore, it is assumed that relative prices have remained unchanged since 1979.
- Employment impacts are based on labour productivity in British Columbia during the year 1979, adjusted to 1986 dollar terms.
- Induced impacts of increased household consumption as a result of higher economic activities are estimated on the basis of the following:
  - household income is defined to include wages and salaries, supplementary labour income and income of unincorporated businesses.
  - the marginal, personal income tax rate is assumed to be 27% of total income.
  - the average saving rate is assumed to be 13% of total disposable income.
- There is likely a further induced impact arising from responding of increased corporate cash flow and government revenues. However, these are not estimated in the closed model with respect to the household sector.

APPENDIX B

LIST OF WRITTEN SUBMISSIONS

AND

TELEPHONE CONFERENCES

WRITTEN SUBMISSIONS

S.D. #	S.D. NAME	PRESENTED BY:
17	Princeton	Board of Trustees
24	Kamloops	T.D. Grieve, Asst Superintendent Kamloops Sr. Sec.- J.M. Stewart-Smith Overlander Sec.-John Zordell, Chairperson Phil Claydon-Elem. Computer Committee David Thompson-Elem. Consultation Committee
26	North Thompson	Ed Shook, Trustee David A. Yule W.M. Jory
29	Lillooet	Catherine R. Williams-Calgary, Alberta
30	South Cariboo	Coppervale Elem. Ashcroft - D. Nowoselski
33	Chilliwack	Administration Staff Chilliwack Sr. Sec.-Math Dept.
34	Abbotsford	Mr. R. Arden, Dir. of Instruction Mr. P. Brinton, Supervisor of Special Ed. Mr. D. Driver, Teacher Mr. B. Dudzik, Teacher Mrs. J. Haste, Teacher Mr. P. Henman, Teacher Mr. C. Kiyooka, Teacher Mr. D. Nicholas, Principal Mr. G Roger, Teacher Mr. J. Tucker, Teacher Chief Dan George Elementary, Ian Harrison
35	Langley	H.D. Stafford Jr. Sec. R. MacKenzie-Langley INED Teachers' Assoc. Dr. Shirley McBride, Sup. of Special Serv. Mike Baker Langley School District
36	Surrey	N. Surrey Sec.-Mr. Lock Gibbs

S.D. #	S.D. NAME	PRESENTED BY:
37	Delta	Alice McQuade, Delta Business Ed. Assoc.
38	Richmond	Richmond Elem-R. Farquhar Computer coordinators & consultants R. Bearisto, Computer Coordinator
39	Vancouver	John Wormsbecker, Deputy Supt. Lower Mainland Spec. Ed. Administrators Sir Charles Tupper Sec.-E.L. Colledge Vanc. School Administrators Assoc. Prince of Wales Sec.-Barbara Annandale Vanc. Evaluation & Research Services District Parent Representatives of Vanc. Sir Charles Tupper Sec.-E. Sunday David Thompson Sec.-Dr. Dallas E. Hinton & Mr. Frank Ludwig Prince of Wales Sec.-Christopher Bowers Vanc. Technical Sec. Betty Wellburn, Coordinator Barry MacDonald, Coordinator Vanc. S.D.-Computer St.11/Computer Sc.12
40	New Westminster	Board of School Trustees
41	Burnaby	Neil Carey, Teacher/Librarian Morley School-Paul Bird Burnaby Central Sr. Sec.-Karam Gopaulsingh Confederation Park-Fred W. Rezanson Burnaby Central Sr. Sec.-Streb Collins John Stephen Henrichsen
42	Maple Ridge-Pitt Meadows	Maple Ridge Elem.-Jeff Tarris M.R.I.E.A. Computer Committee Jim Graham, Computer Resource Person Rick Withers, Coordinator of Educ. Computing Maple Ridge Elem.-Ed Swaren & Rick Withers Maple Ridge Sec. School
43	Coquitlam	Centennial School-Ken Kuhn Terry Fox Sr. Sec.-W. George Buckley Centennial Computer Science Dept. Terry Fox Sr. Sec.-Jim Block

S.D. #	S.D. NAME	PRESENTED BY:
44	North Vancouver	Brian Fairholm District Computer Policy Committee North Vanc. Teachers' Assoc. N. Vanc. S.D. Computer Sc./Studies Teachers Alan D. Pay, Teacher/Librarian North Vanc. School Board Carson Graham - Brian T. Cousins Visual Art Teachers of North Vanc. Ron Payne, Industrial Ed. Teacher North Vancouver Teachers Argyle Sec.-Bob Cullen Argyle Sec.-J.G. Mann Richard Strachan, Strachan Computers North Vanc. Industrial Ed. Teachers
45	West Vancouver	Patrick W. Bickford, parent Lions Bay-Gisela Loh Peter & Helen Minshull, parents R.J. Pellatt West Vanc. Teachers' Assoc. Hillside Sec. Sheila Carston, parent Lions Bay School Parent Assoc.
46	Sunshine Coast	Madeira Park Elem.
48	Howe Sound	Howe Sound Sec.-Leo Hubner Garibaldi Highlands Elem. Howe Sound Sec.-Detlef Rudolph Howe Sound Sec.-Frank W. Baumann Mamquam Elem.-David H. Cromack The Fund for Excellence in Education Sc. Board Office Media Centre in Squamish
50	Queen Charlotte	Queen Charlotte Elem.Sec.-Dr. J.L. Gaskill
55	Burns Lake	W. Petersen, Asst. to the Supt.
57	Prince George	Barbara Hall, B.C. Teacher-Librarians' Ass. Brian & Maureen Shields, Teachers Jim Swanson Harry M. Hufty Computer Applications Steering Committee Curriculum Development & Implementation

S.D. #	S.D. NAME	PRESENTED BY:
59	Peace River S.	Steve Rison, parent
60	Peace River N.	Duncan Cran Elem.-Linda Penner Elmer G. Kabush North Peace Sec.-Jim Norris North Peace Sec.-Bruce Cummings North Peace Sec.-Greg Lindsay North Peace Sec.-John Manly Total North Communications
61	Greater Victoria	Ron Roe GVSD Computing Advisory Committee Denis Simair, Computer Coordinator Lambrick Park Sec.-Mrs. Berne J. Neufeld St. Margaret's School-Margaret Bryant St. Margaret's School-David J. Barlow John Young, Trustee Bill Sloan, Coordinator CSG Careerware
62	Sooke	Dunsmuir Jr. Sec.-P. Rothe, teacher B. Belcher Sooke Primary Teachers' Assoc. Science Specialists' Assoc. of S.D. 62 E.N. Wiens, Director of Instruction Julie Wilmott, Computer Liaison Belmont Sr. Sec.-Margaret Milne
63	Saanich	E.V. Bloom, Consultant (Media & Technology) Keating Elem.-Computer Committee Brentwood School-T.H. Boyd Secondary Computer Users Computer Committee (Questionaire)
65	Cowichan	Cowichan Sec.-Ken Buchholz Cowichan Sec.-C. Fulton Chemainus Sec.-David Towner Alexander Elem.-H.M. Engelson Cowichan Computer L.S.A. George Bonner Jr. Sec. Chemainus Sec.-W.B. Cooper Charles Hoey School Koksilah School Drinkwater Elem. Quamichan Middle School-Science Dept.

S.D. #	S.D. NAME	PRESENTED BY:
65	Cowichan	Chemainus Sec.-R. Bruce Kingham Cowichan Home & School Assoc.
66	Lake Cowichan	Wayne Loutet-Sandpiper Computer Systems Dan Calleberg, Computer Facilitator
68	Nanaimo	Wellington Jr. Sec.-K.L. Abbott John Godfreyson, Coordinator Jim Swift, teacher
71	Courtenay	Mr. B. Mather & Mr. P. Mazzocchi, teachers
75	Mission	Mission Sr. Sec.-Dennis Keis Mission District
80	Kitimat	Roy Wilcox Parent Group
81	Fort Nelson	M. Gilbert, Director of Education R.L. Angus Elem.-I.B. Graham Fort Nelson Sec. Ft. Nelson Campus of Northern Lights College
84	Vanc. Island W.	Capt. Meares School-Marilyn Connolly
85	Vanc. Island N.	A.J. Elliott Elem.-Robert W. Gougeon

TELEPHONE CONFERENCES

Kerry Chalmers, Computer Coordinator, Carlton Board of Education

Anne Jones, Superintendent, Ottawa Board of Education

Duncan McCaig, Director, Infotech Manitoba

David Moursund, Professor, University of Oregon

Douglas Penny, Asst. Deputy Minister, Ontario Ministry of Education

Gene Romaniuk, Professor, Universtiy of Alberta

John Travers, Asst. Director, Computers in Schools, Alberta Education

APPENDIX C

VENDOR PRESENTATIONS

The following companies made presentations to the Committee:

Apple Canada
Association for Educational Software Development
AT&T Canada
B.C. Systems Corporation
B.C. Telephone Company
Breakwater Books
Burroughs Canada
Canada Systems Group
Columbia Computing Services
Computer Distribution Inc.
Commodore
Computech Consulting
Digital Equipment
Education Systems Technology Canada Inc.
Educomp
Entrex Software Inc.
Houghton Mifflin Canada Ltd.
IBM
Intertan Canada Ltd.
Knowledge Network
Laser Publishing Inc.
L R Associates
Matrix Interactive Systems Corp.
Microsoft
Mastertech Laboratories
Mitek
National Geographic Society
Nora Systems
Open Learning Institute
Optimized Computer Systems
Pelton Engineering Ltd.
Prime Computers of Canada
Roland Canada Music Ltd.
Software Industry Development Association
Softwords
Stepping Stones Learning Systems
Strawberry Hill Knowledge Software
Uniwiz
Utlas International
Watcom Group Inc.
Wicat

APPENDIX D

LIST OF RESPONDENTS TO THE INTERIM REPORT

LIST OF RESPONDENTS TO THE INTERIM REPORT

John Barth, Coordinator of Special Services
School District No. 55 (Burns Lake)

Oscar Bedard, Executive Director
Schools Programs Division, B.C. Ministry of Education

Ron Blache-Fraser, Marketing Manager - ICON
Unisys Canada Inc., Vancouver, BC

E. V. Bloom, Consultant, Media & Technology
School District No. 63 (Saanich)

John E. Champ, President
Houghton Mifflin Canada Limited, Markham, ON

Streb Collins, President
Canadian Association of Business Education Teachers
North Vancouver, BC

Rick Connolly, Director of Administration, Special Education
B.C. Ministry of Education
For the Special Education Technology Committee

Bruce P. Corbett, Education Sales Manager
Atari (Canada) Corp., Markham, ON

W. E. Evans, President
British Columbia Systems Corporation, Victoria, BC

Peter Graystone, President
EKEG Electronics Co. Ltd., Vancouver, BC

Mike Hurley
The Neil Squire Foundation, Vancouver, BC

Neil Jackson, Chairman
Building Manual Review Committee
B.C. Ministry of Education, Victoria, BC

D. R. Jomini
Kitimat, BC

James Landy, District Computer Chairperson
School District No. 29 (Lillooet), Lillooet, BC

Gayle Long, Education Consultant
Apple Canada Ltd., Vancouver, BC

Ian Lovatt, Marketing Manager
Education Systems Technology Canada Inc., Willowdale, ON

Graham McKinnon, Associate Executive Director
British Columbia School Trustees Association

Marvin Westrom, Faculty of Education
University of British Columbia, Vancouver, BC
For the Faculty of Education, UBC

Glen Roger, Coordinator, Field Operations Branch
B.C. Ministry of Education, Victoria, BC

Norman Ryal
Vancouver, BC

Gary Scott, Marketing Manager - Education
AT&T Canada Inc., Willowdale, ON

R. Smith, Superintendent of Schools
School District No. 89 (Shuswap), Salmon Arm, BC

Richard A. Strachan,
Strachan Computers Ltd., North Vancouver, BC

Robin Syme, Assistant Director
Curriculum Development Branch
B.C. Ministry of Education, Victoria, BC

John Travers, Associate Director, Computers in Schools
Alberta Education, Edmonton, ##?AB

Jaap Tuinman, Dean, Faculty of Education
Simon Fraser University, Burnaby, BC

Vancouver Computer Science Teachers
School District No. 39 (Vancouver), Vancouver BC

A. E. Williams
Vancouver, BC

Rick Withers, Coordinator of Educational Computing
School District No. 42 (Maple Ridge - Pitt Meadows)

John Wormsbecker, Deputy Superintendent of Schools
School District No. 39 (Vancouver), Vancouver, BC

West Vancouver Computer Committee
School District No. 45 (West Vancouver), Vancouver BC

Queen's Printer for British Columbia ©
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